

## REMARKS

Claims 1-15 and 21 are pending in the application. Claim 1 is the sole remaining independent claim.

Claim 21 has been added by amendment in this response. Claim 21 finds support in Claim 7 as originally filed and in the specification at page 8, lines 9-11. No new matter has been added by this amendment.

Claims 3-5, 8, 10-11, 13 and 14 have been amended to correct typographical errors. No new matter has been added by these amendments.

Applicants note that, although the Examiner stated on the cover sheet of the Office Action that all claims were rejected, the Examiner has offered no rejections for Claims 4, 10 or 11. Applicants therefore understand that these claims are allowable and have limited their argument to rejected Claims 1-3, 5-9 and 12-15.

### Restriction Requirement

The Examiner has rejected Applicants' traversal of the restriction requirement. Applicants confirm their election of claims 1-15 in Group I. Applicants have cancelled Claims 16-20 without prejudice to their right to refile the cancelled claims in a divisional application.

### Objections to the Drawings

The Applicant notes the Draftsperson's Objections to the Drawings. Formal drawings will be submitted upon agreement as to the claims to be allowed in the application.

**Rejection of Claims 7 and 9 Under 35 U.S.C. 112**

The Examiner has rejected Claims 7 and 9 under 35 U.S.C. 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the invention. Specifically, the Examiner has rejected Claim 7 for the use of the word “including,” and for improper use of means-plus-function type claim language. The Examiner has rejected Claim 9 as containing an improper Markush group.

Claim 7 has been amended to remove both the word “including” and the means-plus-function language. The Examiner’s rejection of this claim is therefore overcome by amendment.

Applicants thank the Examiner for noting the typographical error in the Markush language of Claim 9. Claim 9 has been amended in accordance with the Examiner’s suggestion.

Applicants respectfully request that, in view of the amendments to Claim 7 and Claim 9, the Examiner withdraw the Section 112, second paragraph rejections.

**Rejection of Claims 1-3, 5-9, and 12-15 Under 35 U.S.C. 103(a)**

Claims 1-3, 5-9, and 12-15 stand rejected as unpatentable under 35 U.S.C. 103(a). The Office Action has specifically rejected Claims 1-3, 8-9, 12 and 14-15 as unpatentable over U.S. Patent No. 5,759,866 (“Machida”), Claims 8-9 as unpatentable over Machida in view of U.S. Patent No. 5,716,825 (“Hancock”), Claims 5-7 as unpatentable over Machida in view of Lofas et al. (1990), *Chemical Communications*, pp. 1526-1528 (“Lofas”), and Claim 13 as unpatentable over Machida in view of U.S. Patent No. 5,585,069 (“Zanzucchi”).

A *prima facie* case of obviousness based on a combination of references may only be asserted when three criteria have been met: (1) there must be a suggestion or motivation to combine the references, (2) there must be a reasonable expectation that the asserted combination

will be successful, and (3) the asserted combination must teach all of the suggested claim limitations. MPEP § 2142. The first two criteria must be found in the cited references or in the art generally; if the suggestion to combine or the expectation of success is found solely in the application under consideration, an obviousness rejection is improper. *In re Vaeck*, 947 F.2d 488, 493, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991). Moreover, an obviousness rejection is only proper when the teachings of the cited references, considered as a whole, render the claimed invention as a whole obvious. MPEP §§ 2141.02, 2142 (citing *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983)). Applicants respectfully assert that none of the cited references, alone or in combination, meet the criteria for establishing a *prima facie* case of obviousness.

All of the claim rejections are based upon the Machida patent, either alone or in combination with other references. Machida discloses a device for performing immunoassays having a single sample treating and optical measuring zone containing porous material. As the noted in the Office Action, Machida does not disclose or teach (1) multiple sample treating zones (Office Action, p. 4), (2) DNA as a specific binding pair member (Office Action, p. 5), (3) immobilization of the specific binding pair member in a hydrogel (Office Action, p. 6), or (4) electrical methods for pumping fluid through the channel (Office Action, p. 6).

The Office Action asserts that Claims 1-3, 8-9, 12 and 14-15 are unpatentable over Machida because it would be obvious to one of skill in the art to “fabricate more than one sample treating zones in the device of Machida et al. in order to serially perform multiple binding steps in an assay.” (Office Action, p. 4). The Office Action then defines multiple binding steps in an assay by stating that one of skill in the art would use more than one sample treating zone to

“capture multiple analytes in a single flow through”, or to provide an additional zone for “binding of interferents.” (Office Action, p. 4).

A blanket statement that an invention is obvious in view of a reference without support is insufficient to establish a case of obviousness. In this case, no support is cited for the argument that Machida can be modified to include “spatially separated defined regions of [immobilized] specific binding pair members” as required by Claim 1 of the invention. While Applicants agree with the Examiner that multiple zones may be used in a single device to perform for multiple functions, such devices are not what is claimed by Applicants. Applicants indicated that the prior art for DNA hybridization was deficient in that it failed to provide “control of stringency for each individual probe site” (Specification, p. 2, lines 24-25) and in that it failed to provide “an effective solution to maximize hybridization efficiency.” (Specification, p. 3, lines 12-13). Applicants’ invention overcomes these deficiencies by “sequentially placing the DNA probe sites in microfluidic channels such that the DNA probe can efficiently contact its binding partner.” (Specification, p. 4, lines 4-6). Specifically, the claimed invention “provide[s] for optimum contact of the immobilized binding pair member and a binding pair member in fluid flowing through the microchannel.” (Specification, p. 5, lines 15-17). This is reflected in the original language of Claim 1: “...the microchannel contains spacially [sic] separated defined regions of specific binding pair member [sic]....” Thus, if a specific binding pair member in the first defined region is complementary to a given analyte flowing through the microchannel of the claimed device, a specific binding pair member in each subsequent defined region will be complementary to the same analyte. Applicants have amended Claim 1 to more specifically indicate that the defined regions provide for “probe redundancy” in order to maximize efficiency, rather than providing separate functions as suggested by the Office Action’s modifications of the

Machida patent. Machida, either alone or as modified in the Office Action, in no way suggests that the efficiency of the device could be maximized by the use of more than one sample-treating and optical-detecting zone. Applicants therefore respectfully contend that Machida fails to render Claim 1, or any of the claims dependent on Claim 1, obvious and request that the Examiner withdraw the rejection.

Claims 8-9 stand rejected as unpatentable over Machida in view of Hancock. Specifically, the Office Action asserts that Hancock discloses the use of DNA as a specific binding pair member, and this, in combination with the Machida device, renders the claims of the present invention specifically directed to DNA obvious.

Applicants agree that Hancock discloses a microfluidic nucleic acid sample analysis system wherein DNA probes are immobilized in a microchannel. Hancock is only effective to render Claims 8-9 obvious, however, if Machida is effective to render Claim 1 obvious, and if there is a suggestion to combine the two references. Applicants maintain, as discussed above, that Machida does not render Claim 1 obvious, and moreover, there is no suggestion to combine the two references. Machida is specifically directed to immunoassays wherein the specific binding pair members are antigens and antibodies. There is no suggestion that the Machida invention would be useful for analyses involving DNA or RNA specific binding pair members. Hancock does not cure the deficiencies of Machida as set forth above. Applicants therefore respectfully request that the Examiner withdraw the rejection of Claims 8-9.

Claims 5-7 stand rejected as unpatentable over Machida in view of Lofas. Specifically, the Office Action asserts that Lofas discloses the use of hydrogels to promote binding of the specific binding pair member probe to the surface of the microchannel.

Lofas discloses the use of hydrogels for promoting adherence of probes to metal surfaces, specifically gold surfaces. Lofas is only effective to render Claims 5-7 obvious, however, if Machida is effective to render Claim 1 obvious, and if there is a suggestion to combine the two references. Applicants maintain, as discussed above, that Machida does not render Claim 1 obvious, and moreover, there is no suggestion to combine the two references. Machida discloses the use of nitrocellulose filter, cellulose acetate filter, nylon membrane, filter paper and glass fiber filter as the porous material. There is no suggestion in Machida of the use of hydrogels to promote binding of specific binding pair members to the microchannels. Lofas does not cure the deficiencies of Machida as set forth above, and furthermore, there is no suggestion in Lofas that hydrogels are useful for promoting adhesion of biomolecules to non-metal surfaces. Applicants therefore respectfully suggest that the combination of Machida and Lofas fails to render Claims 5-7 obvious, and request that the Examiner withdraw the rejection.

Claim 13 stands rejected as unpatentable over Machida in view of Zanzucchi. Specifically, the Office Action asserts that Zanzucchi discloses the use of electrokinetic pumps for moving sample through the channels of the device, and this, in combination with Machida, renders the claimed device obvious.

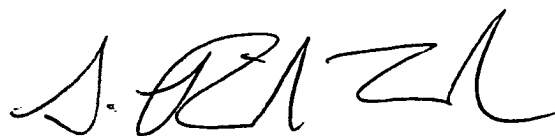
Applicants agree that Zanzucchi discloses a microfluidic diagnostic device that contains multiple parallel pathways in which sample is moved through the pathways by pumps or by application of an electric field. However, Zanzucchi is only useful to render Claim 13 obvious if Machida successfully renders Claim 12 obvious, and there is a suggestion to modify the references. Applicants maintain, as discussed above, that Machida does not disclose or teach the invention of Claim 12, even when a hydraulic pump, rather than an electric field, is used to propel sample through the microchannels of the claimed device. Moreover, Zanzucchi does not

cure the deficiencies of Machida as set forth above. Applicants therefore contend that the combination of Machida and Zanzucchi fails to render Claim 13 obvious and request that the Examiner withdraw the rejection.

### CONCLUSION

For the foregoing reasons, Applicants respectfully assert that all of the claims are in condition for allowance. Applicants therefore request that the Examiner withdraw all rejections.

Respectfully submitted,



S. Richard Carden  
Registration No. 44,588

Date: November 15, 2000

Telephone: 312-913-0001  
Facsimile: 312-913-0002

**McDonnell Boehnen Hulbert & Berghoff**  
300 South Wacker Drive  
Chicago, IL 60606